

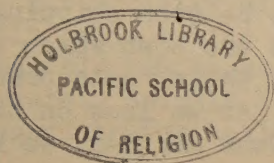
"To promote Christian ideals for agriculture and rural life; to interpret the spiritual and religious values which inhere in the processes of agriculture and the relationships of rural life; to magnify and dignify the rural church; to provide a means of fellowship and cooperation among rural agencies: *Toward a Christian Rural Civilization.*"

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SOILS AND HEALTH in relation to Plants, Animals, and Men

By J. H. Ellis*

There is an ancient Book--which some of us read and the rest of us should--in which is preserved the great fundamental truth recorded by the sages of long ago. This compilation of writings is in nowise an exclusive textbook for the use of the clergy, for its truths are not merely theological but universal. In this Book, at the very outset, the story of creation and the function of the farmer are outlined in terse terms which we may take as the text for our discussion of the subject assigned, i.e., "Soils in relation to Health in Plants, Animals, and Men."

Our text shows that "in the beginning the earth was without form and void; and darkness was upon the face of the deep" until "the Spirit. . . moved upon the face of the waters" after which, in the fullness of time, the dry land was separated from the waters. The dry land was called earth--and "it was good."

The earth then brought forth grass and herbs and trees which likewise were good. The seasons followed in due order. The waters brought forth fish and fowl. The earth brought forth living creatures--beasts, cattle, and man. Finally, the plan set in motion when the Spirit moved over the face of the waters was accomplished. The natural sequence of soils, plants, animals, and men was established, and the function of these great natural objects was outlined. The soils were to produce grasses and herbs for the sustenance of beasts and birds and every creeping thing in which was life, as well as plants bearing seed which were given to man for meat; while man was commissioned "to replenish the earth and subdue it, and to have dominion over all the earth." And when all was finished, behold, "It was very good!"

Whatever others may think of the authenticity of the first story of creation, we as farmers know that the story is eternally true. We see it repeated year by year as the seasons come and go. In the darkness of the winter's

* From an address given by Professor J. H. Ellis, Soils Department, University of Manitoba, at a banquet held on the occasion of the annual meeting of the Manitoba Cooperative Wholesale Ltd.

blizzards the earth appears to be without form and void, but the light and the darkness are resolved into day and night. As the snows melt and spring creeps gradually over the landscape, the waters are again gathered together in the creeks and rivers which flow to the sea or evaporate to form the clouds of water that are above the earth; the dry land appears--and it is good.

With the coming of spring the earth again surges with life; grasses cover the soil with a mantle of green colorfully sprinkled with anemones, three-flowered avens, violets, and hoary puccoons; while in the bush, pin cherry, choke cherry, saskatoon, and wild plum blossoms are full of promise. Fish again run in the creeks; meadow larks and robins return; the prairie chickens can be heard drumming in the great outdoors; and on the farm, chickens appear like little balls of yellow fluff and a new crop of lambs and calves are to be seen skipping in barnyards and pastures. In the fields and gardens, seeds are sown which spread green hands above the soil to catch the sunlight and send their roots down into the good earth in search of water and mineral nutrients. As we look on this annual miracle of creation in the quiet peace of an early June morning, we know that all this is good.

Spring passes into summer, and the smell of new mown hay accompanies the first harvest of the products of the soil. As the heat of summer passes into the mellow days of autumn, the hum of threshers and combines tells of the gathering of wheat to provide earth's millions with daily bread. Granaries bulge with barley and oats for the hogs and cattle. Potatoes and roots are lifted from the garden and stored in cellars where the shelves already sag with the weight of preserved fruits.

Thus the story is again told; the miracle has again taken place; the soil has produced another crop of plants to feed another generation of animals and men. But as the years go by, and as we now look on all these works, it can be said, as it was said of the first creation, "Behold, it is very good!"

FOOD AND HEALTH

What do we imply by goodness when speaking of the products of the garden, field, and range? Truly it is good to have an abundance, i.e., high yields and good returns, but abundance of itself is not goodness. Goodness in food plants should imply the possession of those qualities that satisfy the food requirements of animals and men for heat, for energy, for growth, for body repair, and for reproduction. To be healthy is to be well fed. If the foods produced by farm and garden satisfy all food requirements so that bodies can be kept in health, then the works of our hands are good.

On the other hand, the efforts of the lords of creation have not been good if the women develop goitre, if the babies have rickets, if the men cannot work because they are crippled with arthritis, if the children have white spots on their teeth, if the girls have anaemia, if the sows produce litters of hairless pigs, if the cows won't breed, if the calf and lamb crop is light, if the sheep's wool is brittle and uneven in quality, if the horses have alkali sickness, or if the chickens have crooked bones and the hens lay soft-shelled eggs. If these forms of ill health are present, they point to the fact that the lords of creation have failed in the job of having dominion, because these disorders are evidences of malnutrition and faulty feeding.

INTERDEPENDENCE OF NATURAL OBJECTS

There is a world of mineral elements (the lithosphere or rocks) under our feet. There is a world of gaseous elements (the atmosphere or air) surrounding us and above our heads. Circulating by physical forces between these two worlds is a world of water (hydrosphere). These three worlds are linked together by a world of living matter (biosphere) brought into being by that mysterious thing called life. But all these worlds--the mineral world, the gaseous world, the world of water, and the living world--are combined in that complex world we call soil. Chemically, then, we have the fundamental fact that soils, plants, animals, and men are composed of similar chemical elements differentially combined into organic and inorganic components.

These four great natural objects, i.e., soils, plants, animals, and men, are interdependent. They all have a common need of minerals, and if a certain chemical element (or elements) is deficient in the soil, the whole subsequent cycle of life will be affected. In other words, soils determine plants; plants determine animals; and plants and animals determine men. Fertile soils are required to produce the nutritious plants necessary to insure healthy animals and humans. Conversely, malnutrition and certain forms of ill health in men and animals can be traced back to deficient plants and to deficiencies in the soils that produced them.

MALNUTRITION IN HUMANS AND IN ANIMALS

It is, of course, recognized that living organisms are subject to a multitude of diseases resulting from various causes, but in the present discussion of soils and health, we are obviously restricted to disorders and malnutrition which arise from soil deficiencies.

The nutritional disorders of animals and men that have been traced to soil characteristics may be grouped into two classes: first, maladies such as bone disorders, nutritional anaemia, goitre, and other disorders that appear to be due to a deficiency of one or more of the mineral elements; and second, disorders that result from excessive amounts of selenium, fluorine, and nitrates.

MALADIES DUE TO MINERAL DEFICIENCIES

The common disorders of bones may result from a number of causes including: a deficiency of calcium, a deficiency of phosphorus, a deficiency of vitamins, and the inability of the skeleton to keep the calcium, etc., in the blood at the required level.

Disorders of bones may occur in a number of forms. One form of bone disorder is caused by excessive porosity of the bones due to the removal of the minerals. Another form occurs when nature attempts to repair the damage done to the skeleton because of the transfer of calcium and phosphorus from the bones to the blood. If the bone is growing in young animals and calcification is incomplete, the bones are weak and the well-known distortion characteristic of rickets develops.

Bone disorders from a deficiency of calcium and phosphorus are well known in various countries by such local names as "styfsiekte" in South Africa, "cripples" in Australia, "knockenweicke" in Central Europe, "loin disease,"

"aphosphorosis," etc., in North America, and by such technical names as "osteomalacia" and "osteoporosis," etc.

Poultry kept on soils low in lime and fed on grain low in calcium, without access to calcareous grit, also develop bone disorders or produce soft-shelled eggs.

Human beings may also be affected by disorders similar to those occurring in livestock. Human beings also frequently suffer from soft teeth, tooth cavities, stiffening of the joints, and arthritic pains. A farmer in a certain district in Manitoba wrote stating that in his district there was hardly a man over forty-five years of age capable of doing a full day's work. This had caused him to suspect that the soil was responsible. Our work has shown that the soils in that district are low in phosphate. Consequently we recommended the application of phosphate for the garden crops. Unfortunately we have no data on the mineral content of the vegetables grown in the gardens, but the medical officer to whom we referred this trouble recently informed us that the use of phosphate as a mineral supplement in the diet of certain of the affected persons had apparently overcome the difficulty.

The blood of animals and men also may be subject to maladies arising from mineral deficiencies. Nutritional anaemia is a common disorder caused by a deficiency of iron or by the failure to assimilate the iron that is present. In this disorder the number of red blood corpuscles is drastically reduced. Nutritional anaemia in stock has been found associated with certain soils in different countries. A very definite correlation exists between certain soils and the occurrence of anaemia in general. Nutritional anaemia is known as "bush sickness" of cattle and sheep in New Zealand, as "soil sickness" in Florida, as "nakurutitis" in Kenya, and as "pining" in sheep in Scotland.

Another type of disorder in animals and men is caused by a deficiency of iodine. It is generally believed that simple goitre is due to a deficiency of iodine either in the food or in the water, but it may be due to a number of factors which bring out the insufficiency. The occurrence of goitre in humans and in sheep is well known in this province, and litters of hairless pigs may be mentioned as further evidence that iodine deficiency is a local problem.

There are two mineral elements which are of vital importance to animals and men but these appear to be of little significance in the nutrition of plants. These elements are sodium and chlorine which together form common salt. Stanley (H. M.) tells of the intense craving for salt by the pygmies of Central Africa. The universal presence of salt on dining-room tables indicates not only its human requirement but also the general inadequacy of the food to supply these elements. The two elements in common salt appear to be of little use in plant nutrition and the quantities in plants are usually quite low unless the plants are grown in saline soils.

EFFECT OF MOBILITY ON NUTRITION

The effect of soils on malnutrition in plants, animals, and men is complicated by their respective mobility. Plants by virtue of their immobility are dependent solely on the soil in which their roots are developed. Moreover, not only may the mineral composition of the plants be affected but, in the case of pastures and range, the plant species composition may be markedly modified because

of differences in soil. In one portion of the pasture or range the vegetation may consist of a wide variety of grasses and herbs, and in another portion of the pasture or range the plant species present may be much less numerous and of quite different food value. In a cultivated field a mixture of grasses and legumes may thrive, but in another portion of the same field the legumes may not become established and the grasses only may persist. (Fields in which alfalfa cannot be established should be viewed with suspicion.)

In contrast to plants, animals have mobility. However, farm animals may be dependent on the sustenance given in feed lot and stable or on the feeds provided on the range and pasture sites within which they are confined. In such cases the mobility of the animals is restricted. The fact that cattle thrive on certain soils better than others is a well-known fact, and it is uncanny how the dumbest old cow seems to know which portion of the field has been treated with phosphate. Animals have an instinct, or else they develop some sense of values, in regard to the healthfulness of feeds.

EFFECT OF SOILS ON TYPES, BREEDS, AND CHARACTER

In addition to the immediate interaction of soils, plants, animals, and men, we should not overlook the long-time effects of soil fertility on men and on animals. Throughout the ages the size and vigor of animals, and the character of men, have been influenced by the nitrogen hidden in soil organic matter and by the chemical elements hidden in the soil minerals. These hidden elements exercise a dominant measure of control over the life which the soils support, and because they are variables, it is only to be expected that the living organisms which these elements support are dependent variables.

What part the cumulative long-time effects of the varying levels of organic matter and of soil minerals may have had on fixing types and breeds of farm animals is perhaps difficult to prove. However, it is important to note that the small breeds of horses, i.e., Shetland, Welsh, and Irish ponies, were developed in areas with poor thin soils, whereas the larger breeds of horses, i.e., Shires, Clydes, Percherons, and Belgians, were developed to perfection on the better agricultural soils or on soils made highly productive by careful farming.

On the hills and mountains of the British Isles the native breeds of cattle and sheep are in marked contrast to those developed on the fertile plains and valleys. The question may be asked, "Was any vigorous outstanding breed of livestock ever produced on infertile or deficient soils?"

To what extent have the specific characters of the various peoples been determined by the soils from which they drew their sustenance and to what extent has the moral health of man been influenced by the soil? One thing is certain, the moral character of men is affected profoundly by their attitude to the soil, and there is one outstanding lesson among others that we can learn from history, i.e., it is in replenishing the earth, not in exploiting it, that men have found happiness and have become truly great.

Various aspects of this question are worthy of discussion in local study groups. For example, in the prairie lands we have inherited a goodly heritage. These lands originally were so good that some believed there was no need to replenish the earth. We now see both in soils and men evidence of fifty years

of taking without giving.

There are also in Canada and elsewhere lands of very low productivity. We can all call to mind certain districts where poor husbandmen are trying to eke out an existence on impoverished lands. The economic conditions of such are serious enough, but the effect on the health of mind and soil is tragic indeed.

In referring to the effect of soil culture on man himself in the British Isles, Stapledon (R. G.) writes, "In order to engender a healthy creative spirit, I believe there is nothing to match concentration on the land itself-- a keen desire to care for the land and to maintain the land in good heart."

TWO FUNDAMENTAL RESPONSIBILITIES

As farmer-distributors there are two fundamental responsibilities that must be faced, and the manner in which these responsibilities are faced will determine the success of the movement and the moral character of the members.

The first responsibility is one that all farmers have in common, of being good husbandmen and fulfilling the divine injunction to replenish the earth and subdue it. The second responsibility as distributors is to make sure that the food products distributed are of good quality, and to be of good quality these products must keep the nation healthy.

In other words, the health of the nation is, to a large extent, in the hands of the farmers and the food producers. Veterinarians may be able to put drug-store remedies into the feed box to relieve disorders of livestock; physicians may prescribe pills, capsules, and tonics in an attempt to cure the ills of mankind brought about by faulty food products; but the farmer has the job of preventing malnutrition by producing and distributing the perfect diet for the nation.

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